

## EVALUATION OF NUTRITIONAL VALUE OF WATER LETTUCE (*PISTIA STRATIOTES*) MEAL AS PARTIAL SUBSTITUTION FOR FISH MEAL ON THE GROWTH PERFORMANCE OF *CYPRINUS CARPIO* FRY

MOHAPATRA S. B<sup>1</sup> & PATRA A. K<sup>2</sup>

<sup>1</sup>Department of Zoology, Banki Autonomous College, Banki, Cuttack, Odisha, India

<sup>2</sup>P.G, Department of Zoology, Utkal University, Vani Vihar, Bhubaneswar, Odisha, India

### ABSTRACT

An experiment of 120 days was conducted to evaluate the nutritional quality and acceptability of *Pistia stratiotes* meal as component in the diets of *Cyprinus carpio* fry under laboratory culture condition. Four different feeds comprising *Pistia*, fish meal, GNOC, rice bran, and soybean were used to formulate compound diets by replacing fish meal with *Pistia* at 0%, 15%, 30% and 45% level. The so prepared feeds were given to fish fry @ of 5% of body weight per day. All the experimental diets with different level of inclusion of *Pistia* favoured the growth performance of fry. The highest growth rate was recorded by low inclusion of *Pistia*. There was no significant difference ( $P < 0.05$ ) between the weight gains recorded for the experimental diets. On the basis of the finding, the results showed that a diet consisting of *Pistia* up to 45% level could be used as a replacement for fish meal in the diet of common carp fry.

**KEYWORDS:** *Pistia*, Feed Ingredients, Fish Meal, Growth Performance, *Cyprinus Carpio*

### INTRODUCTION

The efficacy of artificial feed in promoting maximum growth in a fresh water culture system depends upon the quality, quantity and feeding strategies employed. Besides of balance nutrients, feed should be palatable and economically viable. Selective utilization of various aquatic weeds in aquaculture is one of the best ways to overcome the utilization of fish meal as protein source in compound diets. Supplementary feeding in a culture practice system varies in accordance to need of the fish cultivated. Rahman et al. (2006) observed that the production of Common carp showed 1.5 and 2.1 times higher when fed with a compound diet containing fish meal, mustard oil cake and rice bran, than fed with a diet without supplementary feed in culture system. Common carp fed with animal and plant based diet showed prominent effect of specific growth rates, protein efficiency ratio as well as growth rate as compared to animal based diet Nandeesh et al. (2001).

Fish meal is the major source of protein in aquaculture feeds because it is a good source of essential amino acids, fatty acids, vitamins, minerals and enhances palatability (Daving and Arnold, 2000). Although, fish meal is highly demanded, it is however limited in supply and the price is very high. For the reason, a lot of studies have been conducted on finding an alternative to fish meal that are less competitive and with low cost (Yilmaz et al., 2004). The use of plant protein materials in fish diet is desirable due to their low prices and regular availability. (Fagbenro, 2000).

The effectiveness of the leaves of various terrestrial and aquatic macrophytes for partial replacement of fish meal in carp diets has been investigated by a number of workers (Ray and Das, 1992, 1994, 1995, Mandal and Ray, 1998, 1999; Bairagi et al, 2002a, 2004, Mohapatra and Patra, 2013a, 2013b). *Pistia stratiotes* is one of the most abundantly growing

aquatic weeds in tropical and sub-tropical countries. This first growing plant is a good source of animal feed and one of the rich sources of organic resources, has received attention for its utilization. Studies have been conducted on the utilization of *Pistia* however information on the use of *Pistia* in common carp diets are scanty.

The possibility of using *Pistia* in *Cyprinus carpio* feeding as a source of protein and energy in place of fish meal is quite prominent, therefore this study was conducted to evaluate the nutritive value of *Pistia* as alternative protein feed stuff and its effect on growth performance of common carp.

## MATERIALS AND METHODS

The common fry carp were obtained from government fish feed hatchery and maintained in laboratory under optimum conditions on the feed supplement containing rice bran and GNOC in order to habituate them for artificial feeding. The fry were fed with artificial diet twice daily at the rate of 5% body weight per day during the entire experimental period of 120 days. All the fry were weighed every 15 days and the ration was readjusted on the basis of their body weight.

### Experimental Diets

The raw material used in this experiment for compound feed preparation were *Pistia stratiotes*, trash fish GNOC, rice bran, and soybean. All these ingredients were procured from local area and then subjected to sundry to remove moisture and improve the grinding efficiency. Each of the ingredients used to prepare fish feed were thoroughly grinded to uniform level of powder form. All these dry powdered materials were thoroughly mixed into a paste by adding water, and then four dry diets were prepared in which fish meal was replaced with *Pistia* meal at 0%, 15%, 30% and 45% levels. The diets were fortified with vitamins and salts.

### Experimental Procedure

The feeding trial was conducted in 12 glass aquaria and triplicate tanks were used for dieting treatment. The glass aquaria were properly washed and rinsed with clean water. The working dimension of each aquarium was 60x40x45 cm<sup>3</sup>. The experimental aquaria were supplied with borehole water with continuous aeration by using air pumps to ensure proper oxygenation. The common carp fry of average body weight were distributed in to 12 groups of 15 fish in each group. Water quality was monitored every 10<sup>th</sup> day for temperature, pH, dissolved oxygen and total alkalinity. The study was carried out for 120 days. All fish were collected separately from each replicate experimental aquarium and weighed to assess the growth performance of fish at the end of the experiment.

### Chemical Analysis

Feed ingredients, experimental diets were analyzed for proximate composition according to AOAC (1995). The water quality parameters were monitored by following the methods outlined by APHA (1998). Fish performance in term of weight gain (%), were calculated.

### Statistical Analysis

Statistical analysis of data was performed by analysis of variance (ANOVA) using Microsoft software statistical followed by Duncan's multiple range test (Duncan, 1955).

## RESULTS & DISCUSSIONS

Experimental diets containing different proportion of raw materials used (*pistia*, fishmeal, soybean, groundnut oil cake, rice bran, vitamin, and salt) in the present study are shown in Table 1. Table 2 shows the proximate analysis of *pistia* based experimental diets. The results obtained for growth performance characteristic of the fry are presented in Table 3. The percentage of crude protein, crude lipid, ash, moisture and crude fibers in the formulated fish diet were ranged from 34.32-40.12 %, 5.4-8.5%, 11.2-13 %, 1.4-2. 2% and 4.1-4.9 % respectively. The highest percentage of crude protein (40.12%) was recorded at 0% replacement of *pistia* feed and the least (34.32%) was at 45% replacement.

**Table 1: Percentage Composition of Experimental Feed of *Pistia***

Ingredients	Percentage Inclusion of <i>Pistia</i>			
	0%	15%	30%	45%
<i>Pistia</i>	0	3.9	7.8	11.7
Fish meal	26.5	22.6	18.7	14.8
Soybean	20	20	20	20
Groundnut oil cake	30	30	30	30
Rice bran	22	22	22	22
Vitamin	1	1	1	1
Salt	0.5	0.5	0.5	0.5
Total	100	100	100	100

**Table 2: Proximate Composition of Experimental Feed of *Pistia***

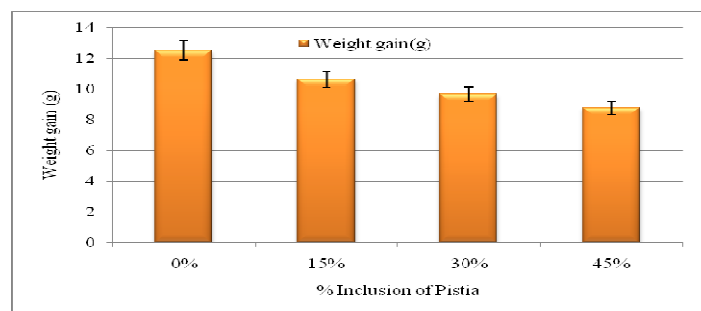
<i>Pistia</i> Feed	% Crude Protein	% Crude Lipid	% Ash	% Moisture	% Crude Fibre
0%	40.12	8.5	13.0	2.2	4.9
15%	36.18	6.3	12.8	1.5	4.1
30%	35.64	5.8	11.6	1.4	4.3
45%	34.32	5.4	11.2	1.5	4.7

**Table 3: Growth Performance of Common Carp Fry Fed *Pistia* Meal Based Feed for 120 Days ( $\pm$ SE)**

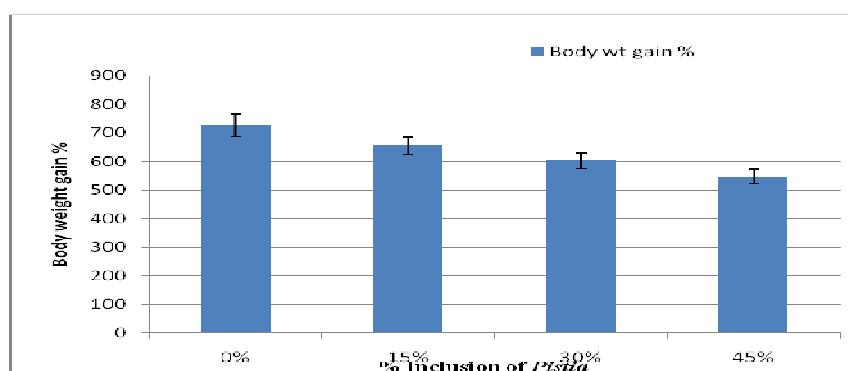
Parameters	0%	15%	30%	45%
Initial wt (g)	1.72 $\pm$ 0.21	1.62 $\pm$ 0.19	1.60 $\pm$ 0.18	1.60 $\pm$ 0.18
Final Wt (g)	14.22 $\pm$ 0.72	12.23 $\pm$ 0.61	11.25 $\pm$ 0.54	10.34 $\pm$ 0.49
Total wt gain (g)	12.50 $\pm$ 0.62	10.61 $\pm$ 0.50	9.65 $\pm$ 0.48	8.74 $\pm$ 0.43
Body wt. gain %	726.74 $\pm$ 3.86	654.938 $\pm$ 2.93	603.125 $\pm$ 2.78	546.25 $\pm$ 2.62
Growth rate(g/day)	0.104 $\pm$ 0.02	0.088 $\pm$ 0.03	0.080 $\pm$ 0.03	0.072 $\pm$ 0.03
% of survival	87	80	73	64

*Pistia* meal in different percentage level was incorporated to replace fish meal to formulate cost effective fish feed. The three inclusion level *pistia stratiotes* in the experimental feed supported the growth for *Cyprinus carpio*. However, growth performance was higher by low inclusion of level of *pistia* meal in the experimental diet. Ray and Das (1996) have evaluated the suitability of dried aquatic weed (*Pistia stratiotes*) meal in the pelleted feed of *Labeo rohita* fingerlings. In contrast, in the current experiment, common carp fry fed diets containing different amounts of *Pistia* shows insignificant differences with respect to growth or feed utilization. Yilmaz *et al.*, (2005) reported no significant difference between the growth performance of fish that were fed diets containing up to 20% duckweed and fish that were fed the

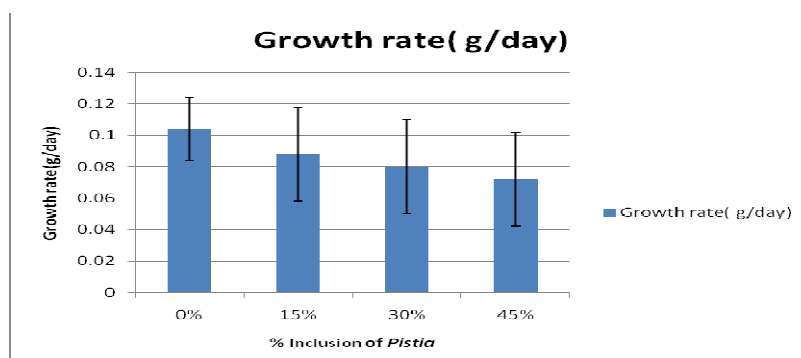
control diet in the common carp, *Cyprinus carpio* fry. The study clearly showed that fish fed diet with 15% *Pistia* dietary inclusion performs excellently well compared to 30% and 45% inclusion. The highest growth rate of the fish fry was  $0.104 \pm 0.02$  (g/day) in 0% followed by 15%, 30%, 45% *Pistia* fed fish meal. The performance characteristic of the fish fed *pistia* was shown in Figure 1, 2 and 3. The present study also corroborate with the findings of Ray and Das (1996).



**Figure 1: Total Weight Gain (g) of Carp Fry Fed with % Inclusion of Pistia Based Diet ( $\pm$  Se)**



**Figure 2: Total Weight Gain % of Carp Fry Fed with % Inclusion of Pistia Based Diet ( $\pm$  Se)**



**Figure 3: Growth Rate (g) Per Day of Carp Fry Fed with % Inclusion of Pistia Based Diet ( $\pm$ SE)**

At higher levels of plant protein, there was a tendency to a negative effect on growth. In this study, there is a tendency of reduction in survival and growth rate when plant protein fishmeal was increased as a protein source, but the effects are not significant. Similar results have been reported in the experiment mentioned before (Albriksen *et al.*, 2003) where significant effects of replacements were observed. It is presumably due to the fact that the results from the present experiment represent for 120 days only and the fish might need more time to grow for a longer period to find statically significant differences.

During early stages of development, fry of fish species require high protein diets for their growth (Huet 1972). It is difficult to substitute high quality fish protein for preparation of artificial diets in aquaculture practice. However, partial substitutions of fish meal are being prepared by inclusion of other ingredients (Li *et al.* 2002, Li and Selle 2002, Tabe *et al.* 2002, Chen *et al.* 2002).

The present study satisfied that *Cyprinus carpio* fry could be successfully reared on artificial diets and also suggests that it is possible to substitute fishmeal with *Pistia* based fish feed for *Cyprinus carpio* fry.

## CONCLUSIONS

Common carps are of great commercial value as food in all part of the globe. Carp utilizes natural food as well as artificial food. Formulated feed plays a pivotal role in increasing fish production. The formulation of balanced feed have received considerable attention in recent years to replace the expensive fish meal component with less expensive plant protein feed stuffs. The present experiment concludes that partial substitution of fish meal can be done by utilizing *Pistia* meal as an ingredient in diets of fish. The study also revealed that utilization of *Pistia* up to 45% level to replace fish meal promotes growth in the diets of *Cyprinus carpio* fry. Further, the aquatic weed, viz. *Pistia* meal provides an easy, practical and cheaper fish feed stuff because of its easy availability.

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